

WHAT IS CLAIMED IS:

1. A zoom lens unit for forming a subject image on an image pick-up device, comprising:

a stationary part;

5 first and second movable parts to reciprocate in predetermined directions by being guided by the stationary part, each movable part having electrodes formed on surfaces and supporting a lens, at least one of the electrodes being one used to hold the movable  
10 part;

wherein the stationary part comprising:

a driving electrode substrate having a plurality of groups of electrodes formed thereon in a predetermined direction at a constant pitch to drive  
15 the first and second movable parts;

a holding electrode unit having a pair of electrodes corresponding to the electrodes of the first and second movable parts to selectively attract and hold the first and second movable parts; and

20 a drive control circuit for sequentially energizing the groups of the electrodes of the driving electrode substrate as well as for selectively energizing the electrodes of the holding electrode unit,

25 wherein the drive control circuit executes a cycle at least once while at least one of the first and second movable parts moves one pitch of an electrode of

the plurality of groups of the electrodes when the first and second movable parts are moved in a different direction,

wherein the cycle comprises:

5           a first operation for simultaneously grounding the electrodes of the first movable part and the electrodes of the holding electrode unit corresponding to the electrodes as well as attracting the first movable part to the driving electrode substrate by energizing at  
10       least one group of the electrodes of the plurality of groups of the electrodes;

          a second operation executed just after the first operation to energize ones of the holding electrodes and the electrodes such that the first and second  
15       movable parts are attracted to the pair of electrodes of the holding electrode unit;

          a third operation executed just after the second operation to simultaneously ground the electrodes of the second movable part and the electrodes of the  
20       holding electrode unit corresponding to the electrodes as well as to attract the second movable part to the driving electrode substrate by energizing at least one group of the electrodes of the plurality of groups of the electrodes; and

25       a fourth operation executed just after the third operation to energize ones of the holding electrodes and the electrodes such that the first and second

movable parts are attracted to the pair of electrodes of the holding electrode unit.

2. A zoom lens unit for forming a subject image on an image pick-up device, comprising:

5 a stationary part;

first and second movable parts to reciprocate in predetermined directions by being guided by the stationary part, each movable part having electrodes formed on surfaces and supporting a lens, at least one of the electrodes being one used to hold the movable part;

wherein the stationary part comprising:

a driving electrode substrate having a plurality of groups of electrodes formed thereon in a predetermined direction at a constant pitch to drive the first and second movable parts;

a holding electrode unit having a pair of electrodes corresponding to the electrodes of the first and second movable parts to selectively attract and hold the first and second movable parts; and

a drive control circuit for sequentially energizing the groups of the electrodes of the driving electrode substrate as well as for selectively energizing the electrodes of the holding electrode unit,

wherein the drive control circuit executes a cycle at least once while at least one of the first and

second movable parts moves one pitch of an electrode of the plurality of groups of the electrodes when the first and second movable parts are moved in a different direction,

5           wherein the cycle comprises:

          a first operation for simultaneously grounding the electrodes of the first movable part and the electrodes of the holding electrode unit corresponding to the electrodes as well as attracting the first movable part  
10       to the driving electrode substrate by energizing at least one group of the electrodes of the plurality of groups of the electrodes;

          a second operation executed just after the first operation to energize ones of the holding electrodes  
15       and the electrodes such that the first and second movable parts are attracted to the pair of electrodes of the holding electrode unit;

          a third operation executed just after the second operation to simultaneously ground the electrodes of  
20       the first movable part and the electrodes of the holding electrode unit corresponding to the electrodes as well as to attract the first movable part to the driving electrode substrate by energizing at least one group of the electrodes of the plurality of groups of  
25       the electrodes; and

          a fourth operation executed just after the third operation to energize ones of the holding electrodes

and the electrodes such that the first and second movable parts are attracted to the pair of electrodes of the holding electrode unit.

3. A method of driving a zoom lens unit comprising:

a step of executing a cycle at least once while at least one of a first movable part and a second movable part moves one pitch of an electrode of a plurality of groups of electrodes,

wherein the cycle comprises:

a first step for simultaneously grounding the electrodes of the first movable part and the electrodes of a holding electrode unit corresponding to the electrodes as well as attracting the first movable part to a driving electrode substrate by energizing at least one group of the electrodes of the plurality of groups of the electrodes;

a second step executed just after the first step to energize the holding electrodes and the electrodes such that the first and second movable parts are attracted to a pair of electrodes of the holding electrode unit;

a third step executed just after the second step to simultaneously ground the electrodes of the second movable part and the electrodes of the holding electrode unit corresponding to the electrodes as well as to attract the second movable part to the driving

electrode substrate by energizing at least one group of the electrodes of the plurality of groups of the electrodes; and

5 a fourth step executed just after the third step to energize ones of the holding electrodes and the electrodes such that the first and second movable parts are attracted to the pair of electrodes of the holding electrode unit,

10 wherein the stationary part, which causes the first and second movable parts each holding a lens to execute a zoom operation by guiding the first and second movable parts so as to reciprocate in a predetermined direction as well as by driving them in a different direction, comprises:

15 the driving electrode substrate having the plurality of groups of the electrodes formed thereon in a predetermined direction at a constant pitch to drive the first and second movable parts; and

20 the holding electrode unit having the pair of electrodes corresponding to the electrodes of the first and second movable parts to selectively attract and hold the first and second movable parts.

4. A method of driving a zoom lens unit comprising:

25 a step of executing a cycle at least once while at least one of a first movable part and a second movable part moves one pitch of an electrode of a plurality of

groups of electrodes,

wherein the cycle comprises:

a first step for simultaneously grounding the electrodes of the first movable part and the electrodes of a holding electrode unit corresponding to the electrodes as well as attracting the first movable part to a driving electrode substrate by energizing at least one group of the electrodes of the plurality of groups of the electrodes;

10 a second step executed just after the first step to energize the holding electrodes and the electrodes such that the first and second movable parts are attracted to a pair of electrodes of the holding electrode unit;

15 a third step executed just after the second step to simultaneously ground the electrodes of the first movable part and the electrodes of the holding electrode unit corresponding to the electrodes as well as to attract the first movable part to the driving electrode substrate by energizing at least one group of the electrodes of the plurality of groups of the electrodes; and

25 a fourth step executed just after the third step to energize ones of the holding electrodes and the electrodes such that the first and second movable parts are attracted to the pair of electrodes of the holding electrode unit,

wherein the stationary part, which causes the first and second movable parts each holding a lens to execute a zoom operation by guiding the first and second movable parts so as to reciprocate in a predetermined direction as well as by driving them in a different direction, comprises:

the driving electrode substrate having the plurality of groups of the electrodes formed thereon in a predetermined direction at a constant pitch to drive the first and second movable parts; and

the holding electrode unit having the pair of electrodes corresponding to the electrodes of the first and second movable parts to selectively attract and hold the first and second movable parts.